



Advanced Demo Project Status and Future Direction

Kate Miller





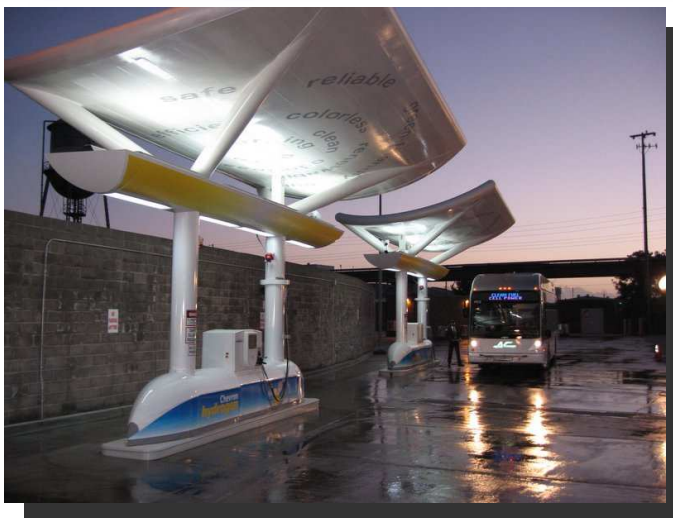
Performance

- 3 Hydrogen-Electric Hybrid Buses
- 152,000 Miles (as of 03/09/09)
- 370,000 Passengers
- 72% to 100% Better Fuel Economy
- 181 Tons of CO2 Reduced
- 35,000 Diesel Gal. Saved





Oakland Energy Station



- Startup – November 2005
- Natural Gas Steam Reformer
- 150 kg/day; 366 kg Storage
- **34,000 kg** dispensed (as of 05/10/09)
- No safety incidents





AC Transit for the Environment

Fuel Economy – Diesel Equivalent MPG



NREL 2008 Technical Reports

Bus	Mileage (Fuel Base)	Hydrogen (kg)	Miles per kg	Diesel Equivalent Amount (Gallon)	Miles per Gallon (mpg)
FC1	19,897	3,138.2	6.34	2,777.1	7.16
FC2	18,683	3,024.2	6.18	2,676.3	6.98
FC3	23,611	3,819.6	6.18	3,380.1	6.99
FCB Total	62,191	9,981.9	6.23	8,833.6	7.04
1043	43,835			10,765.1	4.07
1044	42,379			9,916.2	4.27
1045	44,256			10,381.1	4.26
1046	45,518			10,873.8	4.19
1047	45,673			10,744.5	4.25
1048	42,914			10,295.4	4.17
Diesel Total	264,575			62,976.1	4.20

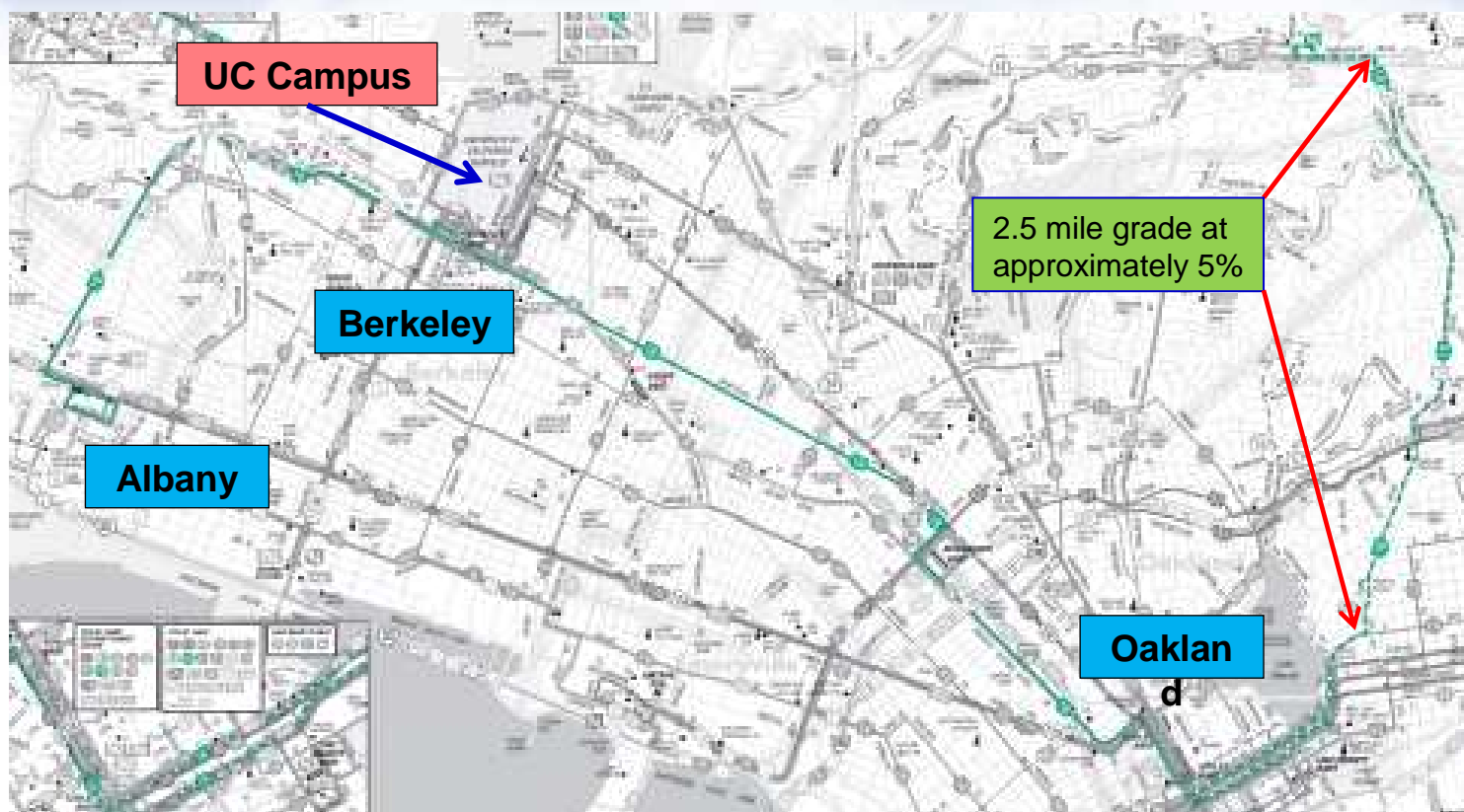
AC Transit: 7.04 vs. 4.20

Bus	Mileage (Fuel Base)	Hydrogen (kg) or CNG (GGE)	Miles per kg or GGE	Diesel Equivalent Amount (Gallon)	Miles per Gallon (DGE)
FC1	50,391	7,079.0	7.19	6,264.6	8.13
550 HHICE	42,523	9,807.2	4.34	8,678.9	4.90
563 CNG	83,579	28,038.1	2.98	25,094.1	3.33
565 CNG	101,493	33,977.5	2.99	30,409.9	3.34
566 CNG	85,680	28,608.8	2.99	25,604.9	3.35
567 CNG	82,806	26,767.8	3.09	23,957.2	3.46
568 CNG	101,122	33,404.8	3.03	29,897.3	3.38
CNG Total	454,680	150,797.1	3.02	134,963.4	3.37

SunLine Transit: 8.13 vs. 3.37



18 Line



Line	Pull-out	Pull-in	Total Hours	Platform Miles	Miles/Kg	Kg/Day
18	451a	1203x	19:12	199.06	7	28.44
18	516a	1223x	19:07	199.06	7	28.44
18	611a	1143p	17:32	170.74	7	24.39



Passenger Survey – 429 Passengers

- Funded by Federal Transit Administration
- ACT's Fuel Cell Program – **84% Positive**
- Program's Effect on Opinion of Local Government – **70% Improved**
- Importance of Considering Alternative Fuels – **90% Yes**
- Support Expanded Fuel Cell Bus Program at AC Transit – **81% Yes**



Fuel Cell Bus Fleet Dashboard

Fleet Summary

Fuel Cell Hybrid Bus Fleet		Buses in Operation	Passenger Service	Fleet Hours* Fleet Miles
	AC Transit Oakland, CA	Three	March 20, 2006 to Present	14,484 hours 146,648 miles
	SunLine Transit Thousand Palms, CA	One	December 16, 2005 to Present	5,372 hours 68,334 miles
	CT Transit Hartford, CT	One	April 11, 2007 to Present	4,452 hours 29,727 miles
	Van Hool Antwerp, Belgium	One	June 18, 2007 to Present	3,057 hours 34,206 miles

* Summary as of February 28, 2009

Totals: 27,366 hours
278,915 miles



Zero Emission Bay Area Advanced Demo - “ZEBA”

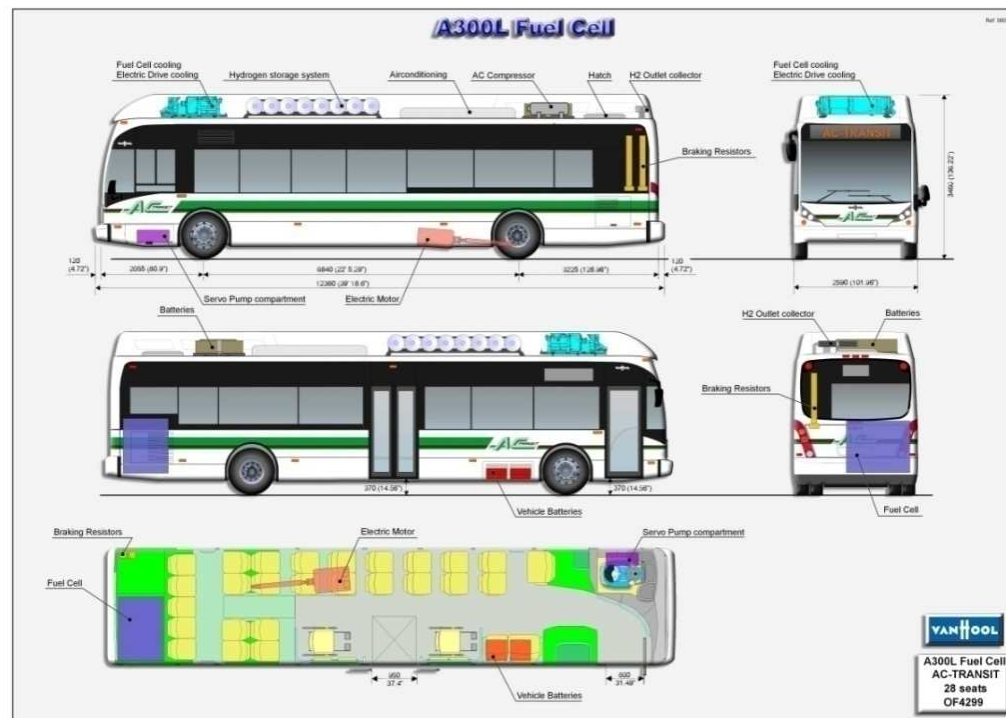
- \$50 to \$56 Million
- 12 New Buses in 2009/2010
- 5 Transit Agencies (>2,500 vehicles)
- Shared Service
- Shared Training





Next-Generation Design – 2009

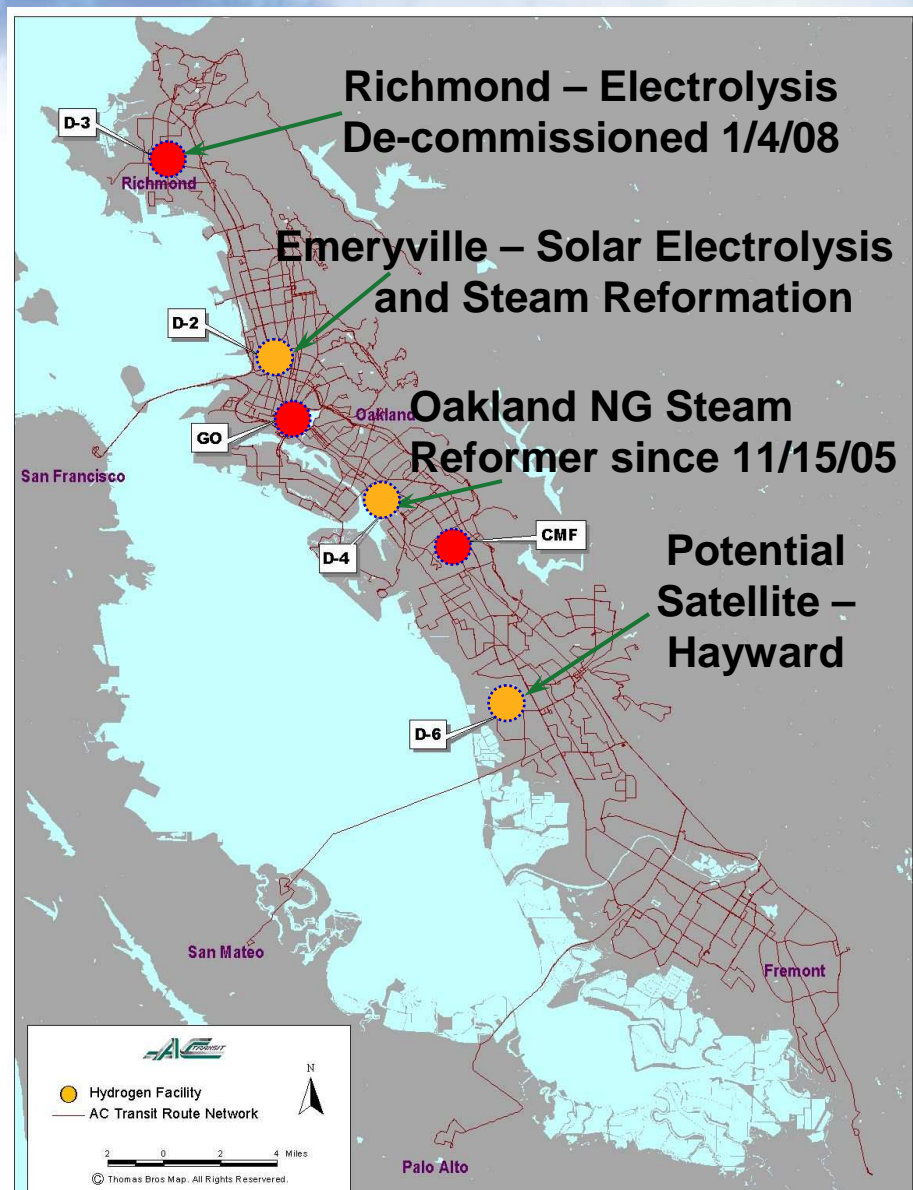
- OEM Integration/Energy Storage (Li-ion)
- Several Thousand Pounds Lighter
- Lower profile
- 55 mph
- 12% Grade
- 12 Buses
- \$2.5 Million/
Per Bus
- **Fleet-Ready**





ZEBA Project Milestones

Milestones	Date
TIP Certification for NFCB Grant	November 1, 2007
1 st Van Hool Contract (8 Buses)	February 6, 2008
1 st UTC Contract (8 + 1 Fuel Cells)	March 31, 2008
VTA – ACT Agreement	December 8, 2008
2 nd Van Hool Contract (4 Buses)	December 15, 2008
2 nd UTC Contract (4 Fuel Cells)	December 19, 2008
Prototype Bus	August 2009
2 nd and 3 rd Buses	Nov/Dec 2009
4 th and 5 th Buses	Jan/Feb 2010
6 th and 7 th Buses	Mar 2010
8 th and 9 th Buses	Apr 2010
10 th and 11 th Buses	May 2010
12 th Bus	Jun 2010



Fueling Stations –

Expand from
150 kg/Day to
400 kg/Day



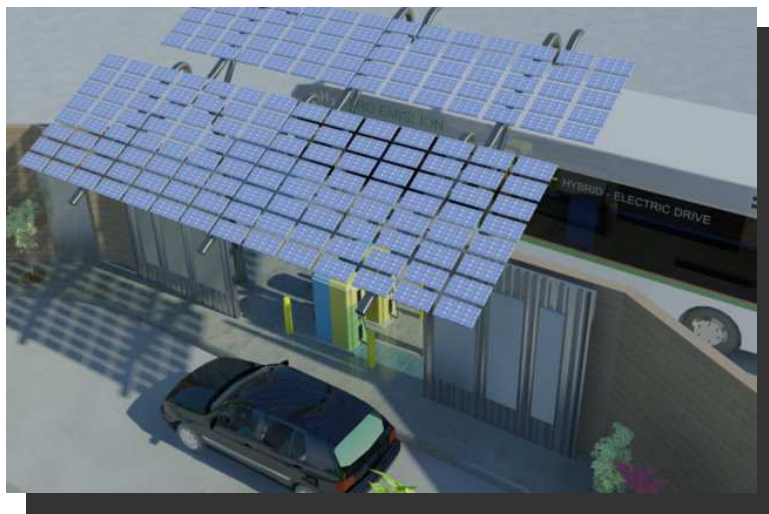
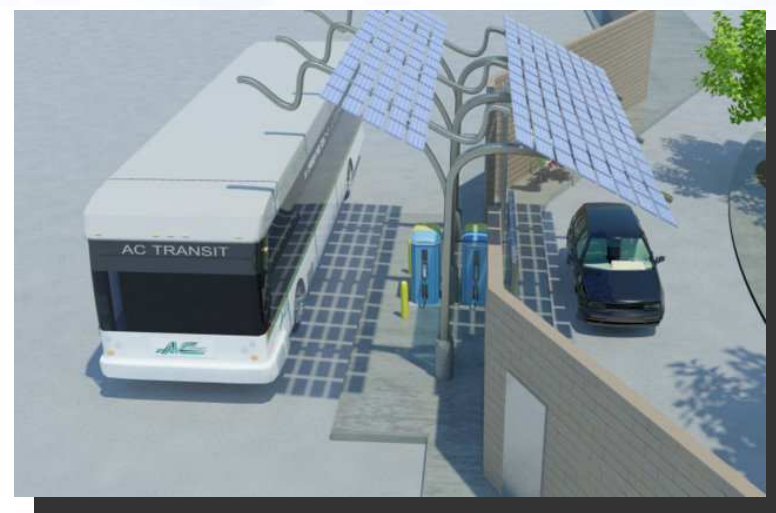
Emeryville Energy Station



- Reformer – ≈ 180 kg/day
- Solar Electrolysis – 60 kg/day
- ≈ 500 to 800 kg Storage
- Up to six buses
- Maximum 20 cars per day
- Startup – January 1, 2010
- **Toyota, Daimler, Hyundai, GM, and Honda** participating



Proposed Bus/Car Fueling





Evaluation

- In Partnership with NREL, FTA, and DOE
- FTA and DOE have approved continued data collection and analysis of eight buses, and will include the additional four
- Monthly and Semi-annual Performance Reports



U.S. Department of Transportation
Federal Transit Administration



NREL National Renewable Energy Laboratory
Innovation for Our Energy Future

A national laboratory of the U.S. Department of Energy
Office of Energy Efficiency & Renewable Energy

Alameda-Contra Costa Transit District
(AC Transit)

Fuel Cell Transit Buses:
Evaluation Results Update

Kevin Chandler, Battelle
Leslie Eudy, National Renewable Energy Laboratory

Technical Report
NREL/TP-560-42249
October 2007





What's Next?

Next Steps	Evaluation Criteria
12 Next-Generation Buses in Service by June 2010	<ol style="list-style-type: none">1. Performance by different operators2. Fuel economy3. RELIABILITY4. Hydrogen Production5. Lifecycle Costs

